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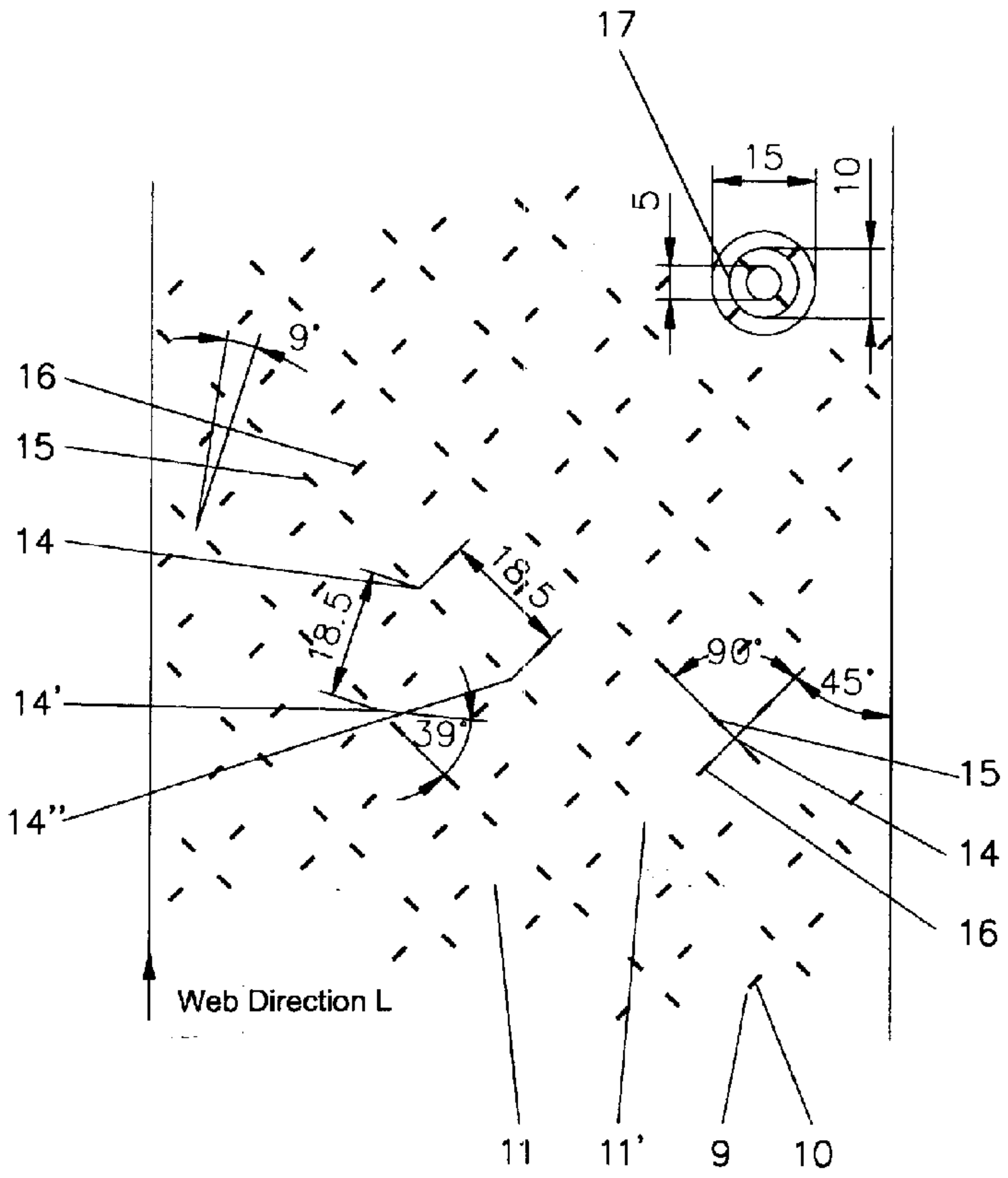
(54) **SAC A FILTRE DE POUSSIERE**
(54) **DUST FILTER BAG**



(57) A dust filter bag is disclosed with a fibrous layer laminated to a paper layer. The fibrous layer consists of synthetic polymeric fibers and is positioned on the clean gas side of the paper layer. To increase the strength of the dust filter bag, the fibrous layer includes melt-bonded polymeric regions end is strengthened itself by the polymeric regions and connected thereby with the paper layer. The polymeric regions have a hot melt area of 0.5 to 10% of the surface, preferably 1 to 3%, whereby a sufficient laminate strength is achieved with minor pressure loss.

ABSTRACT

A dust filter bag is disclosed with a fibrous layer laminated to a paper layer. The fibrous layer consists of synthetic polymeric fibers and is positioned on the clean gas side of the paper layer. To increase the strength of the dust filter bag, the fibrous layer includes melt-bonded polymeric regions and is strengthened itself by the polymeric regions and connected thereby with the paper layer. The polymeric regions have a hot melt area of 0.5 to 10% of the surface, preferably 1 to 3%, whereby a sufficient laminate strength is achieved with minor pressure loss.

DUST FILTER BAG

Field of the Invention

The invention relates to dust filter bags and, in particular, to dust filter bags made of a paper layer laminated together with a fibrous layer.

Background Art

A variety of demands are placed on filter bags of this generic type. It is one goal to achieve a high filter action, i.e., a high degree of separation. The filter pores must be sufficiently small therefor. At the same time, the filter pores of the dust filter bag should not clog, so that a high suction or blowing action, for example, of a vacuum, is maintained and, for this reason alone, the need for a premature exchange of the dust filter bag before a certain degree of fill is reached is avoided.

Furthermore, the dust-filled bags must have a sufficient mechanical strength so that they do not tear or rupture during installation or in the filled condition. A certain degree of strength is also necessary for the manufacture of bags by way of several folding steps.

Dust-filled bags made of a porous fleece layer and a filter paper are known from EP O 635 297 A1, and are processed into dual layer dust filter bags. A meltblown nonwoven can be used as the fleece layer, which covers the inner side of the dust filter bag and reinforces the bag. However, this reinforcement effect is not satisfactory.

Further, dust filter bags are known from EP O 338 479 B1. The dust filter bag described therein consists of a filter paper outer layer and an inwardly positioned fleece layer. The fleece layer is a fine fleece fabric and is also positioned on the airflow incoming side. The fine fibers of the fine fiber fleece can thereby be directly deposited on and connected with the filter paper in the thermoplastic condition. The fine fiber fleece can be connected with a supporting element which is also made of fleece material. For the manufacture of the raw bag, a tube is formed from the laminate which is closed with a longitudinal seam. Pieces of finite length are subsequently cut from the endless tube on the base folding drum. The tube ends are to be opened at one side by an air blast in order to guarantee the formation of flaps which are folded over and glued onto one another. However, since the two inwardly directed fleece layers are slightly welded together during the cutting process, they can no longer be securely opened with the air blast.

A multilayer filter bag is known from DE 196 06 718 A1, which has a first inner layer made of a fine fiber fleece, a second outer layer of entangled polymer material and a third layer of paper material which is positioned in air flow direction before the first layer. The filter efficiency of the layer of paper material is hereby ensured, since the actual filter action would take place before if it were positioned on the outside.

It is a further disadvantage of the known dust filter bags that the filter paper layer softens and loses its strength when water or other liquids are sucked in with the air to be cleaned, whereby a rupturing of the bag during vacuuming or upon removal of the dust filter bag is possible, which results in soiling of the surrounding area. Moreover, the filter action with regard to very fine particulates is not satisfactory.

Summary of the Invention

It is now an object of the invention to provide a dust filter bag which overcomes the above-described disadvantages of dust filter bags known in the art.

It is another object of the invention to provide a dust filter bag which has additional strength and safely contains its contents even upon rupturing of the paper layer.

It is yet a further object of the invention to provide a dust filter bag which can be more easily manufactured in that the polymer fiber layers of the bag are no longer welded together during cutting of an endless tube of the bag material, permitting the ends of severed tube sections to be reliably opened with an air blast.

A dust filter bag in accordance with the invention includes a fibrous layer with fused polymeric regions which are themselves solidified and connected with a paper layer, and have a fusion area of 0.5 to 10% of the total surface. With this construction, even a loss of strength of the paper layer does not result in rupturing of the dust filter bag. The fibrous layer is positioned outside of the paper layer so that even upon rupturing of the paper layer inside the dust filter bag, a spilling of dust particles from the inside of the bag is prevented by the fibrous layer outside thereof. The fusion area of the polymeric regions of 0.5 to 10% of the total surface, preferably 1 to 3%, provides for a sufficient laminate strength with a tolerable increase in the pressure difference.

Despite the possibility of water absorption, the paper layer which is advantageous for the generation of folds can be used. Compared to a pure fibrous layer of polymer fibers, the folding of the dust filter bag is only made possible with the paper layer. The foldability can be improved by using a denser pattern of the fused polymeric regions in the region of the folds.

A maximum extent of the polymeric regions of 1 mm in longitudinal and/or transverse direction, possibly also in diameter, is found especially advantageous for the generation of a sufficient adhesion of the fibrous structure to the paper layer.

The polymeric regions can at least partially penetrate into the paper layer whereby an additional and rigid solidification of the fibrous structure is achieved. The fragile structure of the paper bond is hereby positively changed. The wet strength and/or rupture resistance of the paper layer is definitely improved by the polymeric regions.

The thickness of a polymer region can thereby be smaller than the thickness of the individual layers when layered on top of one another, but especially smaller than the thickness of the paper layer outside the polymer region.

The gas permeability in the polymer region is thereby reduced to a fraction of the value outside the polymer region. The fibrous layer made of synthetic, polymeric fibers is densified to a compact material in this region.

The fibers can be electrostatically charged in order to improve the filter action with respect to fine dust particles.

To complement the fibrous layer of polymeric fibers positioned on the clean gas side, a further fibrous layer of synthetic, polymeric fibers is preferably provided on the dust-laden air side in order to generate a further improvement of certain properties. This, however, leads to an increase in price of the dust filter bag. Thus, in the most preferred embodiment of the present invention, a construction is preferred wherein a layer of synthetic, polymeric fibers is only provided on the clean air side.

The fibrous layer preferably consist of a fleece material of inherent strength in order to ensure that the dust filter bag is sufficiently stable and filter active even upon complete destruction of the paper layer. Thus, this ensures that even in those situations a hygienic removal of an at least partially filled dust filter bag is possible. The fleece layer can be solidified to provide wet strength by a mutual adhesion and/or entanglement of the fibers and/or threads thereof and preferably includes fused polymeric regions to be additionally solidified by these regions and connected with the paper layer. It has been found advantageous to window-like fuse the polymeric regions. Solidification zones are achieved thereby which provide the fleece fabric with improved strength, especially when the polymeric regions are bar shaped.

The polymeric regions can be distributed in a honeycomb or waffle pattern for the formation of dust chambers. While the paper, because of its paper bond, remains rigid and flexible upon exposure to the air pressure acting thereon during the intended use of the dust filter bag, the fibrous layer is elastically deformed on the clean air side in the intermediate zones of the honeycomb or waffle pattern which leads to the formation of dust chambers in which fine dust particles can accumulate. Such a construction has proven excellent for the separation of allergens.

The bars forming the polymeric regions need not be continuous, but can be mutually staggered, which means can be completely separated.

In another preferred embodiment, the fibrous layer of the dust filter bag is made of two sub-layers. This is especially advantageous when the two sub-layers have different functions.

In particular, the sub-layer positioned away from the paper layer of the dust filter bag can be made of a spunbond nonwoven. This spunbond nonwoven generally has a high abrasion resistance. This is especially important when the dust filter bag comes in contact with rough surfaces during manufacture, installation or use. Furthermore, at least one other sub-layer is preferably provided which is adjacent the paper layer and consists of microfibers. In this layer, which preferably is a meltblown nonwoven, improved filter properties are achieved, especially with respect to fine dust particles, whereby the range of uses for the dust filter bag is expanded.

An especially good cleaning effect with sufficient mechanical strength of the dust filter bag is achieved when the fibrous layer of microfibers has a basis weight of 5 g/m^2 to 40 g/m^2 (ISO 536) at a total weight of the fibrous layer of 5 to 50 g/m^2. The paper layer preferably has a basis weight of 20 g/m^2 to 100 g/m^2 (ISO 536). The air permeability of the finished product is preferably about 100 to 300 l/m^2s at a differential pressure of 200 Pa (DIN 53887).

In order to guarantee an optimal processing during manufacture of the raw bag, the dust filter bag must have paper-like properties. This is guaranteed by sufficiently rigidly connecting the fleece layers with the paper. In order to achieve a sufficient strength along the longitudinal seam of the raw bag manufacture, the edge region is preferably especially reinforced, preferably by a welding and/or gluing arrangement.

By positioning the fleece layer on the clean air side of the paper layer, the fleece layers are no longer welded together during cutting of the tube so that the tube ends can be safely opened with an air blast.

Brief Description of the Drawings

The invention will now be further described by way of example only, and with reference to the attached drawing, wherein

FIG. 1 is a cross section through a three-layer dust filter bag in accordance with the invention;

FIG. 2 a plan view of the outer, fibrous layer of the dust filter bag of FIG. 1 with the fused polymeric regions;

FIG. 3a a schematic cross section through the three-layer dust filter bag of FIG. 1 and in the region of the fused polymer region;

FIG. 3b a scanning electron microscope photograph through a dust filter bag in accordance with the invention and in the region illustrated in FIG. 3a; and

FIG. 4 is a perspective end view of a cut open, folded dust filter bag in accordance with the invention.

Detailed Description of the Preferred Embodiment

The preferred embodiment of a dust filter bag in accordance with the invention is shown in FIG. 1. It consists of a paper layer 2 on the dust gas side or suction side 1 of the filter bag. A fibrous layer of polymeric material which is made of a spunbond nonwoven fabric 4 of thermoplastic fibers is positioned on the clean air side 3 of the filter bag. A further fibrous layer of polymeric material which consists of a meltblown nonwoven fabric 5 of thermoplastic fibers is positioned between the paper layer 2 and the spunbond fabric 4.

The paper layer 2 and the meltblown fleece 5 loosely lie one on top of one another in FIG. 1 so that an intermediate space 6 is present. Correspondingly, the spunbond fleece 4 loosely lies on top of the meltblown fleece 5, whereby an intermediate space 7 is enclosed in some regions.

In order to increase the strength of the spunbond fleece 4, it is preferably strengthened by spot welding at individual, spaced apart locations, whereby a surface structure 8 is produced.

FIG. 2 illustrates the surface of the dust filter bag on the clean gas side. The fused polymeric regions 9 are clearly apparent, which are in the shape of bars 10. The bars 10 are staggered and do not touch one another. They can be positioned in any pattern relative to one another and, for example, can form a honeycomb or waffle pattern. The individual chambers 11, 11' are thereby preferably connected and merge into each other through transverse connections in order to optimally use the available filter surface and to avoid pressure peaks in the individual chambers. For this purpose, the bar structures can also be formed by a succession of individual spaced apart weld zones.

The bars 10 thereby delimit dust pockets 11, 11' which are mutually connected and merge into one another because of the interrupted structure of the polymeric regions 9 or the bars 10.

A material exchange between one dust pocket 11 and an adjacent dust pocket 11' is possible, since the dust pockets 11 are not sealed from one another, for example, after clogging of the pores of one chamber, when the pores of the adjacent chamber are still available.

Various possibilities exist for the positioning of the bars or the polymeric regions with respect to this aspect with a view to increase bag strength and, at the same time, allow a mutual separation of the dust particles.

A preferred bar pattern as illustrated in FIG. 2 includes bars positioned around a center 14, in particular, an inner bar 15 and outer bars 16 positioned in circumferential direction thereabout and respectively staggered by 90°, whereby the outer circle 17 about the inner bars 15 coincides with the inner circle along the outer bars 16. The bars 15, 16 each extend away from the center 14 at an angle of 45° to the web direction L of the filter material (see FIG. 2).

The centers 14, 14' and 14" are staggered by 9° clockwise relative to the web direction and by 39° clockwise relative to a line perpendicular to the web direction so that they form an equiangular triangle.

Principally, it is also possible to use point-shaped polymeric regions located at the centers 14, 14' and 14" themselves, instead of the bars 15, 16 positioned around the centers 14, 14' and 14". However, this decreases the strength of the connection even with a constant connection surface, since no further structures are present between these centers. Nevertheless, the material exchanged from one dust pocket to another is improved, whereby a premature clogging of individual regions is avoided.

FIG. 3a shows a cross section in the region of the polymeric regions 9 or bars 10. The polymeric regions 9 can be produced by ultrasound calendering. The thermoplastic material of the spunbond fleece 4 and the meltblown fleece 5 is thereby melted at predetermined locations and connected with the paper layer 2 under high pressure. The type of paper used is thereby not important, as long as sufficient filter properties are provided.

The melted thermoplastic material of the spunbond fleece 4 and the meltblown fleece 5 thereby at least partially penetrates into the paper layer 2. The properties of the spunbond fleece 4 and the meltblown fleece 5 are no longer present in the polymeric regions 9 because of the calendering. Especially, these regions have no more or only insignificant filter activity. The thickness of the polymer region 9 is relatively less than the thickness of the paper layer 2, whereby the polymer region 9 is especially compact.

Dust pockets 11 are formed by the intermediate spaces 6 between the polymeric regions 9, which spaces take up the fine dust particles insofar as they are not directly stored in the paper or the meltblown fleece 5. The spunbond fleece 4 with higher strength characteristics but relatively lower filter effect is used for protection of the abrasion-sensitive meltblown fleece 6. The spunbond fleece 4 essentially has the task to protect the meltblown fleece 6 from abrasion, and to provide the dust filter bag 12 with a significantly improved tear strength while avoiding a considerable impairment of the filter effect, especially upon moistening. It is especially avoided that the paper layer 2 of the dust filter bag 12 ruptures and completely loses its filter effect. It is even possible that the paper layer 2, after moistening, will once again dry during the intended use without considerable impairment of the filter effect.

FIG. 3b is an electron microscope photograph of the fleece configuration schematically illustrated in FIG. 3a.

A three-layer dust filter bag 12 with several folds 13 is shown in FIG. 4. The paper layer 2, the spunbond fleece 4, and the meltblown fleece 5 are not placed one inside the other, but, starting from a flat material, have been formed into the dust filter bag 12 by collective folding.

The connection of the paper layer, the spunbond fleece 4 and the meltblown fleece 5 is achieved by way of the polymeric regions 9. If liquid enters the interior which is delimited by the paper layer on the dust air side and, as a result softens the paper layer 2, the spunbond fleece 4 thereby still reliably holds the dust filter bag 12 together.

Principally, a single nonwoven fabric or fleece fabric of polymeric fibers may be used in place of the spunbond fleece 4 and the meltblown fleece 5, as long as the desired filter properties and strength are achieved.

The laminating of the paper layer 2 with the fibrous layers 4 and 5 can be achieved with various conventional processes, such as hot melt laminating, application of adhesives, etc., but is preferably achieved by thermal bonding.

An increased number of polymeric regions can thereby be provided in the edge region in order to increase the strength along the longitudinal seam of the raw bag manufacture.

Changes and modifications in the specifically described embodiments can be carried out without departing from the scope of the invention which is intended to be limited only by the scope of the appended claims.

CLAIMS

1. Dust filter bag, comprising a fibrous layer laminated to a paper layer, whereby the fibrous layer consists of synthetic, polymeric fibers and is positioned on the clean gas side of the paper layer, the fibrous layer including melt-bonded polymeric regions and being strengthened and connected with the paper layer by the polymeric regions, the polymeric regions having a bonding surface of 0.5 to 10% of the total surface.

2. Dust filter bag according to claim 1, wherein the polymeric regions have an extent of 1 mm in at least one of the longitudinal and transverse direction.

3. Dust filter bag according to one of claims 1 or 2, wherein the thickness of the polymeric regions is less than the thickness of the unbonded fibrous layer and paper layer when layered one on top of another, but especially less than the thickness of the paper layer outside the polymer region.

4. Dust filter bag according to one of claims 1 to 3, wherein the fibers are electrostatically charged.

5. Dust filter bag according to one of claims 1 to 4, wherein the fibrous layer is made of a fleece material of inherent strength.

6. Dust filter bag according to one of claims 1 to 5, wherein the fleece material is strengthened by mutual bonding and/or entangling of the fibers and/or threads thereof.

7. Dust filter bag according to one of claims 1 to 6, wherein the polymeric regions are of window-like appearance.

8. Dust filter bag according to one of claims 1 to 7, wherein the polymeric regions are shaped or distributed in the form of bars.

9. Dust filter bag according to one of claims 1 to 8, wherein the polymeric regions are distributed in one of a honeycomb and waffle pattern for the formation of dust chambers.

10. Dust filter bag according to one of claims 1 to 9, wherein at least one of the polymeric regions at least partly penetrate into the paper layer.

11. Dust filter bag according to one of claims 1 to 10, wherein the wet resistance and tear strength of the paper layer is improved by the polymeric regions.

12. Dust filter bag according to one of claims 1 to 11, wherein the fibrous layer includes at least two sub-layers.

13. Dust filter bag according to claim 12, wherein the sub-layer positioned away from the paper layer is made of a spunbond fleece.

14. Dust filter bag according to claim 12 or 13, wherein at least one sub-layer is provided which is adjacent the paper layer, and consists of micro fibers.

15. Dust filter bag according to claim 14, wherein the sub-layer consisting of micro fibers has a basis weight of 5 to 40 g/m^2.

16. Dust filter bag according to one of claims 1 to 15, wherein the fibrous layer has an overall basis weight of 5 g/m^2 to 50 g/m^2.

17. Dust filter bag according to one of claims 1 to 16, wherein the paper layer has a basis weight of 20 g/m^2 to 100 g/m^2.

18. Dust filter bag according to one of claims 1 to 17, wherein the dust filter bag is a vacuum bag.

19. Dust filter bag according to one of claims 1 to 18, wherein the polymeric regions constitute a bond area of 1 to 3% of the surface.

20. Dust filter bag according to one of claims 1 to 19, wherein the paper layer and the fibrous layer have a higher proportion of polymeric regions in the edge region.

Fig.1

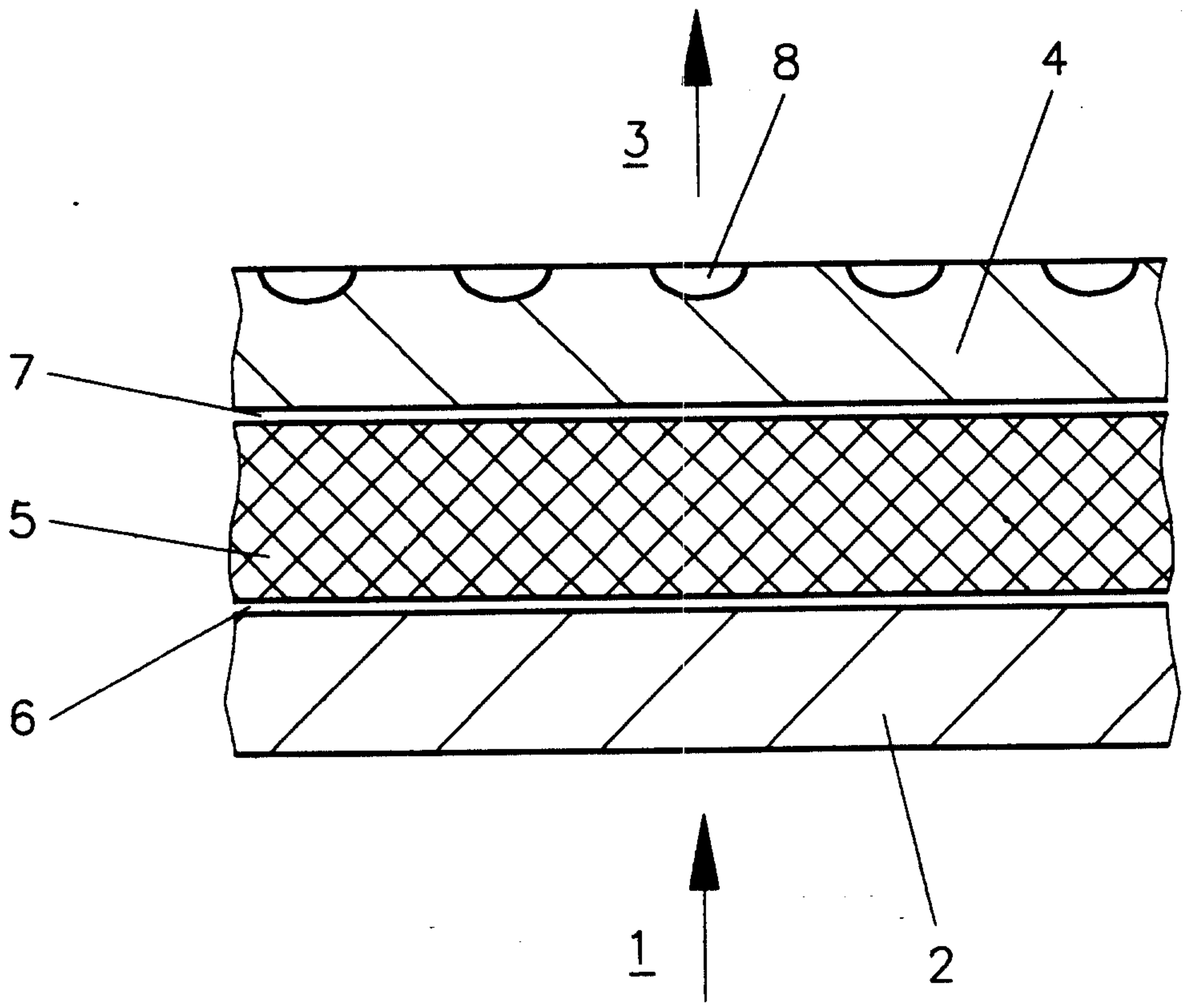
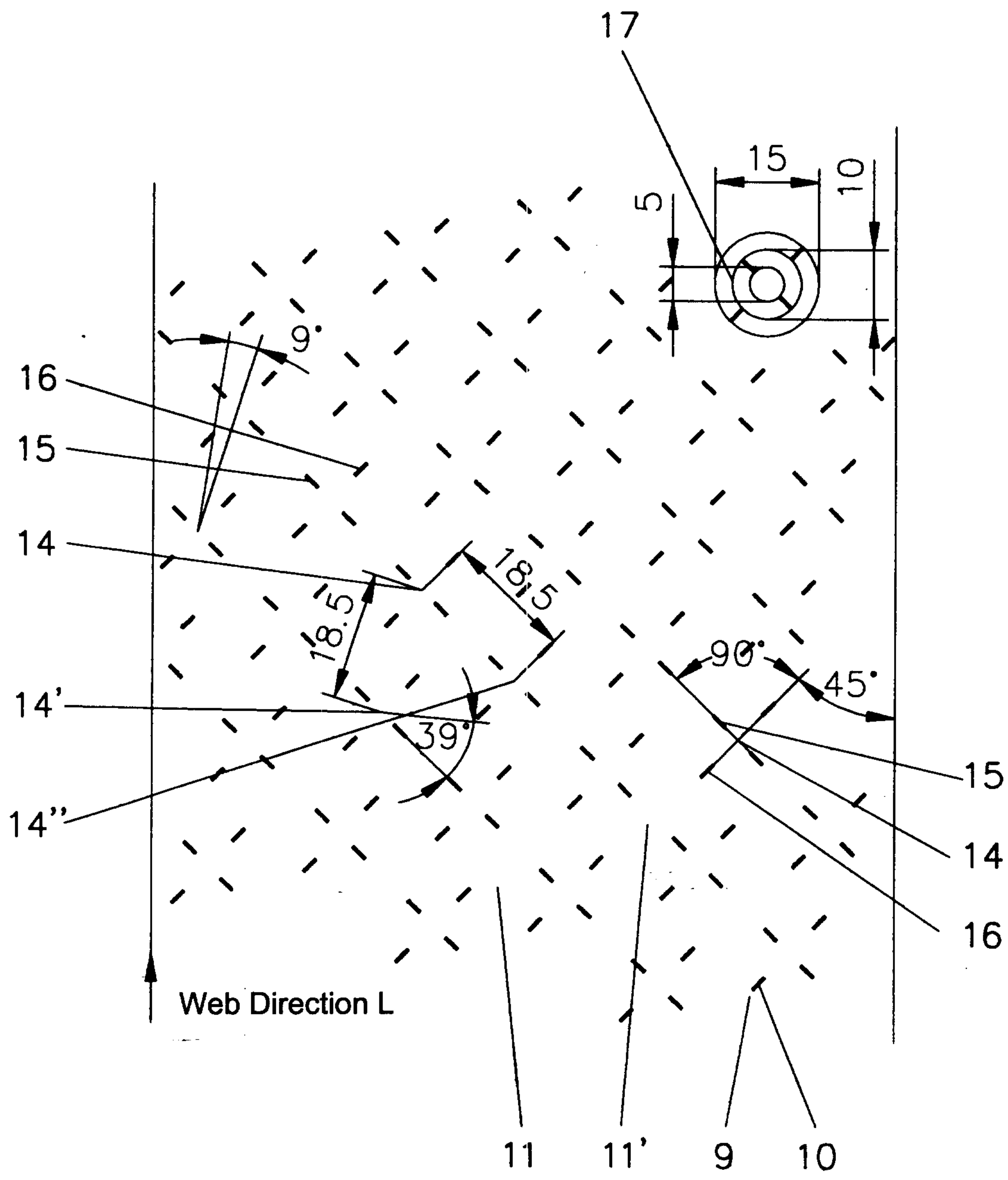
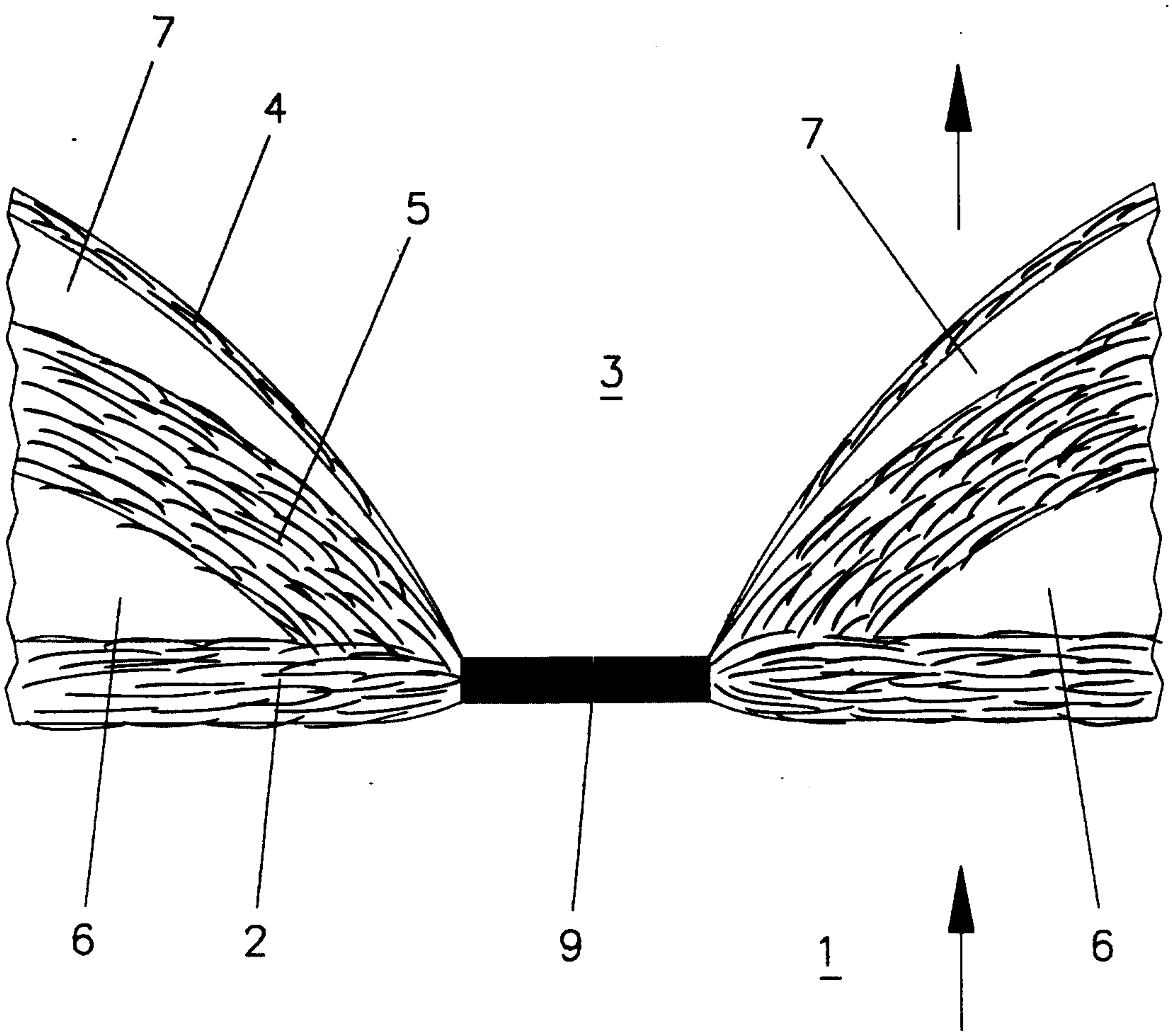


Fig.2



BORDEN ELLIOT SCOTT + AYLEN

Fig.3a



BORDEN ELLIOT SCOTT + AYLEN

Fig. 3b

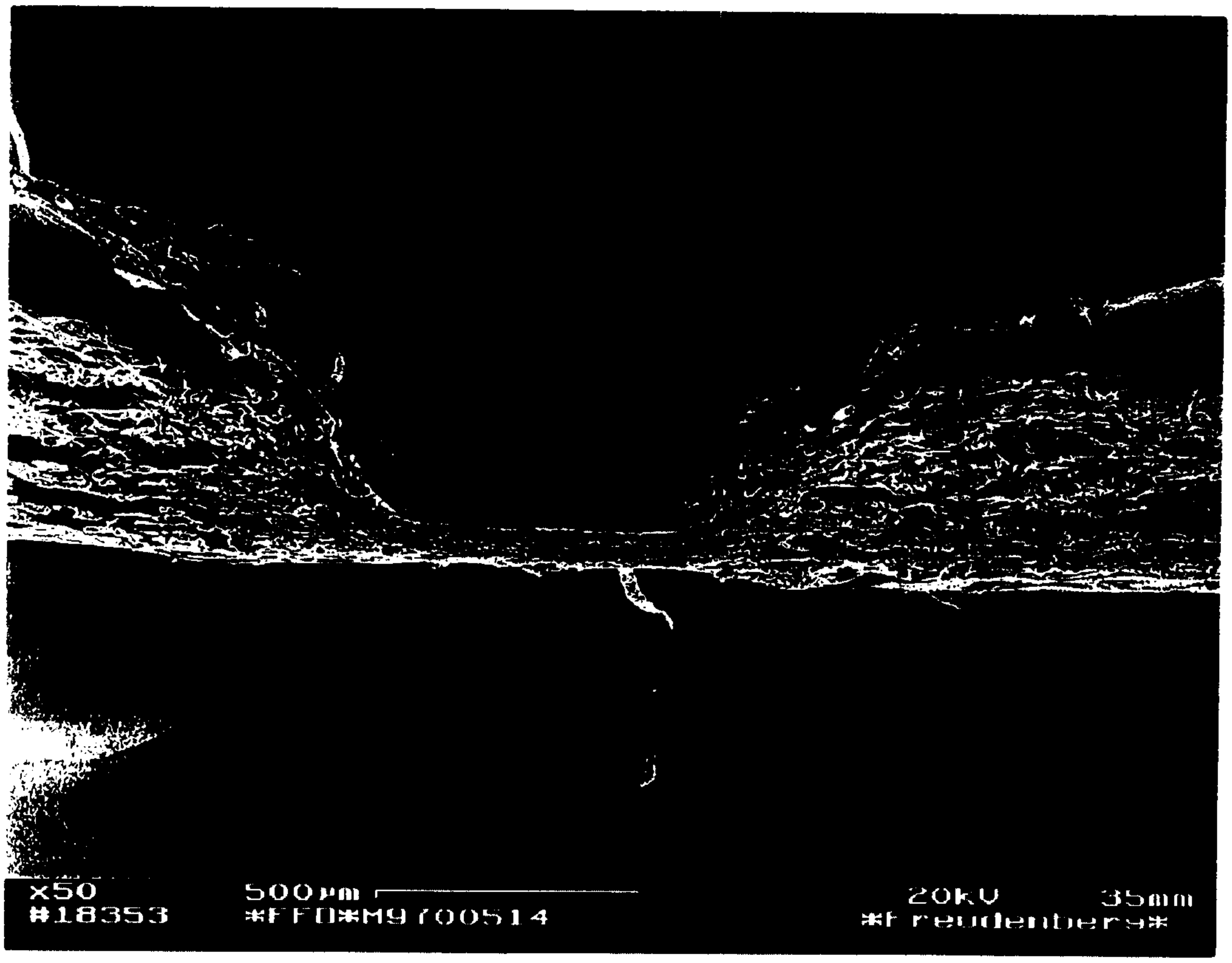


Fig. 4